

Nuclear Energy and Global Governance

Ensuring safety, security and non-proliferation

Trevor Findlay



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Nuclear Energy and Global Governance

The book considers the implications of the nuclear energy revival for global governance in the areas of safety, security and non-proliferation.

Increased global warming, the energy demands of China, India and other emerging economic powerhouses and the problems facing traditional and alternative energy sources have led many to suggest that there will soon be a nuclear energy 'renaissance'. This book examines comprehensively the drivers of and constraints on the revival, its nature and scope and the possibility that nuclear power will spread significantly beyond the countries which currently rely on it. Of special interest are developing countries which aspire to have nuclear energy and which currently lack the infrastructure, experience and regulatory structures to successfully manage such a major industrial enterprise. Of even greater interest are countries that may see in a nuclear energy programme a 'hedging' strategy for a future nuclear weapons option.

Following on from this assessment, the author examines the likely impact of various revival scenarios on the current global governance of nuclear energy, notably the treaties, international organizations, arrangements and practices designed to ensure that nuclear power is safe, secure and does not contribute to the proliferation of nuclear weapons. The book concludes with recommendations to the international community on how to strengthen global governance in order to manage the nuclear energy revival prudently.

This book will be of much interest to students of energy security, global governance, security studies and IR in general.

Trevor Findlay holds the William and Jeanie Barton Chair in International Affairs at the Norman Paterson School of International Affairs, Carlton University in Ottawa, Canada. He is also the Director of the Canadian Centre for Treaty Compliance.

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Foreword

Nuclear issues once again have a pivotal place on the international agenda. In April 2010 a new START Agreement was signed by Russia and the United States that will further cut their strategic nuclear arsenals and renew their bilateral verification arrangements. In the same month US President Barack Obama hosted a special summit on nuclear security that agreed that securing nuclear weapons, facilities and materials is a priority task in preventing nuclear terrorism. A follow-up meeting to check progress will be hosted by South Korea in 2012. In May 2010 the parties to the Nuclear Non-proliferation Treaty successfully agreed a final document, after failure five years earlier, that signals continuing strong multilateral support for the non-proliferation regime. At the Group of Eight summit in Muskoka, Canada, in June, nuclear issues occupied a prominent place on the agenda, including extension of the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction. The International Commission on Nuclear Non-proliferation and Disarmament, for which I served as an advisor, has, meanwhile, elaborated a comprehensive agenda for 'eliminating nuclear threats', including moving towards nuclear disarmament.

Less heartening nuclear developments also make this era pivotal. Both Iran and North Korea continue to defy the international community by refusing to comply with their undertakings to verifiably abjure nuclear weapons. Concerns continue to arise about the extent of nuclear smuggling and the possibility that terrorists might acquire and use radiological or nuclear devices. There remains a deep divide in the nuclear non-proliferation regime between states which have given up nuclear weapons and those which retain them. Three nuclear-armed states, India, Israel and Pakistan, still remain outside the regime. The Comprehensive Nuclear Test Ban Treaty has still not entered into force, while negotiations on a fissile material cut-off treaty have not yet even commenced.

It is in this fraught context that there is increasing speculation about a major, worldwide increase – a 'renaissance' – in the use of nuclear energy for generating electricity, driven by climate change, growing electricity demand and the search for energy security. Yet nuclear energy remains controversial on many grounds: among them cost, safety, security, the nuclear waste question and nuclear weapons proliferation.

In tackling these issues and more, Trevor Findlay's book draws substantially on the research carried out as part of the Nuclear Energy Futures project that I had the pleasure of chairing for the Centre for International Governance Innovation. It reinforces the conclusions reached by that project about both the future of nuclear energy and the implications for nuclear global governance in the areas of safety, security and non-proliferation. Paramount among those conclusions was that, based on a careful calculation of drivers and constraints, the nuclear energy 'renaissance' is likely to be slower and less extensive, at least to 2030, than many anticipate. This is good news for global nuclear governance in that it gives the international community a window of opportunity to deal with the gaps and deficits that are apparent in the myriad treaties, institutions and other arrangements that comprise the nuclear regimes. Action to bolster the regimes is particularly necessary if large numbers of states with no previous experience of nuclear energy are to become owners and operators of nuclear power plants. The International Atomic Energy Agency, the paramount global governance body in the nuclear arena, needs particular attention if it is to be ready for a nuclear energy revival.

With the challenge of nuclear proliferation and nuclear security high on the international agenda, not to mention climate change and energy security which provide the context for increased interest in nuclear energy, Trevor Findlay's book could not be more timely. I commend it to the attention of policy-makers and scholars and students alike.

Louise Fréchette

Louise Fréchette is former Deputy Secretary-General of the United Nations and a Distinguished Fellow at the Centre for International Governance Innovation in Waterloo, Ontario, Canada.

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This work draws substantially on research conducted from 2006 to 2010 as part of the Nuclear Energy Futures (NEF) Project, a collaborative effort by the Centre for International Governance Innovation (CIGI) in Waterloo, Ontario, Canada, and the Canadian Centre for Treaty Compliance (CCTC) at the Norman Paterson School of International Affairs (NPSIA) at Carleton University in Ottawa, Canada. I am indebted to CIGI and its then director John English for appointing me to run the project and to its financial backers for funding the research so generously. I am especially thankful to Louise Fréchette, chair of the project, who first proposed the idea and provided wise policy guidance and furnished high-level support throughout its lifetime.

This book has, naturally, benefitted significantly from the wealth of information, analysis and opinion that emerged from the conferences and workshops, interviews and consultations, and all of the other activities that culminated in the final project report in April 2010. I am particularly grateful to officials of the International Atomic Energy Agency (IAEA) in Vienna for their valuable insights. All of those involved in contributing to the NEF project, including at CIGI and Carleton University, have been acknowledged in the report, which is available at www.cigionline.org.

Of all of the intellectual contributions made to the project which, in turn, have inspired and enabled me to write this book, I am most cognizant of the published NEF papers authored by Justin Alger, John Cadham, Ian Davis, Kenneth Dormuth, David Jackson, Nathaniel Lowbeer-Lewis, David McLellan, Miles Pomper, M. V. Ramana, Aaron Shull and Sharon Squassoni. This book would also not have been as illuminating without being able to draw on the Survey of Emerging Nuclear Energy States (SENES), a database that tracks the progress of countries seeking civilian nuclear energy for the first time and which is a continuing feature of CIGI's website. Several NPSIA Masters students at the CCTC have contributed to SENES at various stages, including Justin Alger, Paul Davis, Amy Fallis, Ray Froklage, Derek de Jong, Jonathan Miller and Alex Sales, along with CIGI's Som Tsoi. For the original graphics and charts contained in this book, most of which were prepared for the NEF report, I acknowledge the work of Derek de Jong, Justin Alger and CIGI graphics designer Steve Cross.

Above all I am grateful to Justin Alger, my former student, principal researcher for the NEF project and Administrator/Researcher at the CCTC. As in all good collaborations between professor and student I have learned a great deal from him. His Masters thesis, 'Nuclear Alibi: the Nuclear Revival and Proliferation' (2009), in addition to dovetailing perfectly with the NEF project, was a significant resource in the writing of the non-proliferation section of this book. In addition to pursuing innumerable research leads and questions, Justin also took on the valiant task of sorting and checking the references, as well as finalizing the charts and graphics. Not least of all he was a constant source of youthful enthusiasm and encouragement.

Finally, I would like to thank Routledge's Andrew Humphrys, who cajoled a book out of me on this subject, and Rebecca Brennan, who expertly steered it to publication.

Acronyms

ABACC	Argentine-Brazilian Agency for Accounting and Control
ABWR	Advanced Boiling Water Reactor
ACR	Advanced CANDU Reactor
ADB	Asian Development Bank
AECL	Atomic Energy of Canada Limited
AFCONE	African Commission on Nuclear Energy
AFNI	L'Agence France Nucléaire International (France)
ALARA	as low as reasonably achievable
ANSN	Asian Nuclear Safety Network
ANWFZ	African Nuclear Weapon-Free Zone Treaty
AP	Additional Protocol (IAEA)
ASE	Atomstroyexport (Russia)
ASME	American Society of Mechanical Engineers
ASN	Nuclear Safety Authority (France)
AU	African Union
BADEA	Arab Bank for Economic Development in Africa
BMWG	Border Monitoring Working Group (IAEA)
BNFL	British Nuclear Fuels Limited
BOG	Board of Governors (IAEA)
BWR	boiling water reactor
CACNARE	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
CANDU	Canada Deuterium Uranium reactor
CBO	Congressional Budget Office (US)
CCGT	combined cycle gas turbine
CCS	carbon capture and storage
CD	Conference on Disarmament (UN)
CDM	clean development mechanism
CENNA	Convention on Early Notification of a Nuclear Accident
CHP	combined heat and power
CIA	Central Intelligence Agency (US)
CISAC	Committee on International Security and Arms Control
CNRA	Committee on Nuclear Regulatory Activities (OECD/NEA)

CNS	Convention on Nuclear Safety
CNSC	Canadian Nuclear Safety Commission (Canada)
CORDEL	Working Group on Cooperation in Reactor Design Evaluation and Licensing (WNA)
CPPNM	Convention on the Physical Protection of Nuclear Material
CSA	Comprehensive Safeguards Agreement (IAEA)
CSS	Commission on Safety Standards (IAEA)
CTBT	Comprehensive Nuclear Test Ban Treaty
CTR	Cooperative Threat Reduction
DOE	Department of Energy (US)
DTI	Department of Trade and Industry (UK)
EBRD	European Bank for Reconstruction and Development (EC)
EC	European Commission
EDF	Electricité de France
EIA	Energy Information Agency (DOE)
ENAC	Early Notification and Assistance Conventions
ENEN	European Nuclear Education Network
ENSREG	European Nuclear Safety Regulators Group
EPAct	US Energy Policy Act (2005)
EPR	Evolutionary Power Reactor (formerly European Power Reactor)
EPREV	Emergency Preparedness Review Teams (IAEA)
EPRI	Electric Power Research Institute
ERNM	Emergency Response Network Manual
Euratom	European Atomic Energy Community (EC)
FAO	Food and Agricultural Organization of the United Nations
FINAS	Fuel Incident Notification and Analysis System
FMCT	Fissile Material Cut-Off Treaty
FMT	Fissile Material Treaty
FOAK	first-of-a-kind
G8	Group of Eight
GAO	Government Accountability Office (US)
GCC	Gulf Cooperation Council
GDP	gross domestic product
GHG	greenhouse gases
GIF	Generation IV International Forum
GNEP	Global Nuclear Energy Partnership
GTCC	gas turbine combined cycle
HEU	highly-enriched uranium
IACRNA	Inter-Agency Committee on Response to Nuclear Accidents
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICJ	International Court of Justice
ICNND	International Commission on Nuclear Nonproliferation and Disarmament

ICRP	International Commission on Radiological Protection
ICSANT	International Convention for the Suppression of Acts of Nuclear Terrorism
IDB	Inter-American Development Bank
IEA	International Energy Agency (OECD)
IMO	International Maritime Organization
INIR	Integrated Nuclear Infrastructure Review (IAEA)
INLEX	International Expert Group on Nuclear Liability
INMM	Institute of Nuclear Materials Management
INPO	Institute of Nuclear Power Operations (US)
INPRO	International Project on Innovative Nuclear Reactors and Fuel Cycles
INRA	International Nuclear Regulators Association
INSAG	International Nuclear Safety Group (IAEA)
INSServ	International Nuclear Security Advisory Service (IAEA)
INSSP	Integrated Nuclear Security Support Plan (IAEA)
INTERPOL	International Criminal Police Organization
IPCC	Intergovernmental Panel on Climate Change
IPFM	International Panel on Fissile Materials
IPPAS	International Physical Protection Advisory Service (IAEA)
IRRS	Integrated Regulatory Review Service
IRS	Incident Reporting System (IAEA/NEA)
IsDB	Islamic Development Bank
ISIS	Institute for Science and International Security
ISSAS	International SSAC Advisory Service (IAEA)
ISSC	International Seismic Safety Centre
ITDB	Illicit Trafficking Database (IAEA)
ITE	International Team of Experts (IAEA)
ITER	International Thermonuclear Experimental Reactor
JREMPPIO	Joint Radiation Emergency Management Plan of the International Organizations
JSW	Japan Steel Works
KEPCO	Korea Electric Power Corporation
LEU	low enriched uranium
LNG	Liquid Natural Gas
LWGR	light water-cooled graphite-moderated reactor
LWR	light water reactor
MCIF	Major Capital Investment Fund (IAEA)
MDEP	Multinational Design Evaluation Program
MIT	Massachusetts Institute of Technology
MOI	Ministry of Industry (Vietnam)
MOST	Ministry of Science and Technology (Vietnam)
MOX	mixed oxide fuel
NASA	National Aeronautics and Space Administration (US)
NCACG	National Competent Authorities' Coordinating Group

NEA	Nuclear Energy Agency (OECD)
NEI	Nuclear Energy Institute
NEPIO	Nuclear Energy Programme Implementing Organization
NERC	North American Electric Reliability Corporation
NERS	Network of Regulators of Countries with Small Nuclear Programmes
NESA	Nuclear Energy System Assessment
NEWS	Nuclear Events Web-based System
NGO	non-governmental organization
NGSI	Next Generation Safeguards Initiative
NIA	Nuclear Industry Association (UK)
NIF	National Ignition Facility (US)
NII	Nuclear Installations Inspectorate (UK)
NNWS	non-nuclear weapon state (NPT)
NPT	Nuclear Non-proliferation Treaty
NRC	Nuclear Regulatory Commission (US)
NSEL	Nuclear Security Equipment Laboratory (IAEA)
NSF	Nuclear Security Fund (IAEA)
NSG	Nuclear Suppliers Group
NSSG	Nuclear Safety and Security Group (IAEA)
NTI	Nuclear Threat Initiative
NTM	National Technical Means
NUSS	Nuclear Safety Standards (IAEA)
NWFZ	nuclear-weapon-free zone
NWMO	Nuclear Waste Management Organization (Canada)
NWPA	US Nuclear Waste Policy Act (1982)
NWS	nuclear weapon state (NPT)
O&M	operation and maintenance
OECD	Organisation for Economic Cooperation and Development
OEF	operating experience feedback
OER	Operating Experience Reports
OSART	Operational Safety Review Teams (IAEA)
PHWR	pressurized heavy water reactor
POC	Point of Contact
PRIS	Power Reactor Information System
PROSPER	Peer Review of the effectiveness of the Operational Safety Performance Experience Review
PSI	Proliferation Security Initiative
PSR	Periodic Safety Review
PUREX	Plutonium Uranium Extraction
PWR	pressurized water reactor
RADWASS	Radioactive Waste Safety Standards (IAEA)
RANET	Response Assistance Network
RBMK	Реактор Большой Мощности Канальный (High Power Channel-Type Reactor) (Russia)

xviii *Acronyms*

RDD	radiological dispersal device
REPLIE	Response Plan for Incidents and Emergencies (IAEA)
RWC	Radiological Weapons Convention
SAGSI	Standing Advisory Group on Safeguards Implementation (IAEA)
SAGSTRAM	Standing Advisory Group on the Safe Transport of Radioactive Materials (IAEA)
SAL	Safeguards Analytical Laboratory (IAEA)
SEDO	Safety Evaluation During Operation of Fuel Cycle Facilities (IAEA)
SENES	Survey of Emerging Nuclear Energy States
SMR	small- and medium-sized reactor
SOER	Significant Operating Experience Reports
SOLAS	International Convention for the Safety of Life at Sea
SQP	Small Quantities Protocol (IAEA)
SSAC	State System of Accounting and Control
STUK	Säteilyturvakeskus (Radiation and Nuclear Safety Authority, Finland)
TTA	Nuclear Trade and Technology Analysis unit (IAEA)
UAE	United Arab Emirates
UNFCCC	United Nations Framework Convention on Climate Change
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
USSPC	ultra-supercritical pulverized coal
VARANSAC	Vietnam Agency for Radiation Protection and Nuclear Safety Control
VVER	Vodo-Vodyanoi Energetichesky Reactor (Russia)
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association
WGRNR	Working Group on Regulation of New Reactors (CNRA)
WHO	World Health Organization
WINS	World Institute of Nuclear Security
WMD	weapons of mass destruction
WMO	World Meteorological Organization
WNA	World Nuclear Association
WNTI	World Nuclear Transport Institute
WNU	World Nuclear University (WNA)

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